

WHAT IS CLAIMED IS:

1. A tone display voltage generating device which includes reference voltage generating means for generating tone display voltages of different levels according to the number of bits of display data, and selecting means for selecting a voltage from the tone display voltages of different levels according to the display data so as to output the selected voltage to a tone display element,

said tone display voltage generating device comprising:

at least one buffer means with a lower output impedance with respect to the reference voltage generating means;

switching means for switching a state of connection between an output stage of the reference voltage generating means, the buffer means, and an input stage of the selecting means, so as to select whether to utilize the buffer means or not when outputting the tone display voltages from the reference voltage generating means to the selecting means; and

first control means for controlling switching operations of the switching means according to a state of tone display of the tone display element,

said at least one buffer means, said switching

means, and said first control means being provided between the output stage of the reference voltage generating means and the input stage of the selecting means.

2. The tone display voltage generating device as set forth in claim 1, wherein:

the output stage of the reference voltage generating means includes output terminals for the number of the tone display voltages of different levels so as to independently output the tone display voltages, and

the first control means controls switching operations of the switching means so that an input of the buffer means is connected to the output terminals in a time sequential manner according to a state of tone display.

3. The tone display voltage generating device as set forth in claim 2, wherein:

the first control means controls switching operations of the switching means so that the output terminals which are connected to the input of the buffer means are switched to output the tone display voltages successively from lower to higher levels, or

successively from higher from lower levels.

4. The tone display voltage generating device as set forth in claim 1, wherein:

the input stage of the selecting means has a plurality of input terminals, and

the first control means switches the switching means according to a state of tone display so that an output of the buffer means is simultaneously connected to at least one of the input terminals, so as to supply any one of the tone display voltages to the input terminals so connected, and

when potentials of the input terminals connected to the output of the buffer means subsequently reach a voltage level of the supplied tone display voltage, the first control means operates to switch the switching means so that the input terminals which have reached this voltage level are disconnected from the output of the buffer means, so as to supply the tone display voltage without utilizing the buffer means.

5. The tone display voltage generating device as set forth in claim 1,

said reference voltage generating means being provided in plurality, and the tone display voltages

generated by the plurality of reference voltage generating means being different for each reference voltage generating means,

said tone display voltage generating means further comprising:

switching means for switching the reference voltage generating means for use; and

second control means for controlling switching operations of the switching means according to a state of tone display of the tone display element.

6. The tone display voltage generating device as set forth in claim 1, wherein:

the reference voltage generating means is made up of a plurality of reference voltage generating blocks for partially generating the tone display voltages of different levels, and

the buffer means is provided for each of the reference voltage generating blocks.

7. The tone display voltage generating device as set forth in claim 1, wherein:

the reference voltage generating means is adapted to receive only two reference voltages, the two reference voltages being used to generate the tone

display voltages of different levels.

8. A tone display device, comprising:

the tone display voltage generating device of claim 1; and

a tone display element which carries out tone display by the tone display voltages which are supplied from said tone display voltage generating device.

9. A tone display voltage generating device which includes reference voltage generating means for generating tone display voltages of different levels according to the number of bits of display data, and selecting means for selecting a voltage from the tone display voltages of different levels according to the display data so as to output the selected voltage to a tone display element,

said tone display voltage generating device comprising:

at least one voltage generating means, having a lower output impedance with respect to the reference voltage generating means, for generating the tone display voltages of different levels;

switching means for selecting whether to output the tone display voltages of different levels from the

reference voltage generating means to the selecting means, or from the voltage generating means of a lower output impedance to the selecting means; and

first control means for controlling switching operations of the switching means according to a state of tone display of the tone display element.

10. The tone display voltage generating device as set forth in claim 9, wherein:

the first control means controls switching operations of the switching means so as to time-sequentially switch the tone display voltages supplied from the voltage generating means of a lower output impedance to the selecting means.

11. The tone display voltage generating device as set forth in claim 10, wherein:

the tone display voltages of different levels outputted from the voltage generating means of a lower output impedance to the selecting means are switched successively from lower to higher levels, or successively from higher to lower levels.

12. The tone display voltage generating device as set forth in claim 9, wherein:

the input stage of the selecting means has a plurality of input terminals, and

the first control means switches the switching means according to a state of tone display so that an output of the voltage generating means of a lower output impedance is simultaneously connected to at least one of the input terminals, so as to supply any one of the tone display voltages to the input terminals so connected, and

when potentials of the input terminals connected to the voltage generating means of a lower output impedance subsequently reach a voltage level of the supplied tone display voltage, the first control means operates to switch the switching means so that the input terminals which have reached this voltage level are disconnected from the voltage generating means of a lower output impedance, so as to supply the tone display voltage from the reference voltage generating means.

13. The tone display voltage generating device as set forth in claim 9, comprising:

a plurality of reference voltage generating units including the reference voltage generating means and one or more of the voltage generating means, the tone

display voltages of different levels generated by the reference voltage generating units being different for each reference voltage generating unit;

switching means for switching the reference voltage generating units for use; and

second control means for controlling switching operations of the switching means according to a state of tone display of the tone display element.

14. The tone display voltage generating device as set forth in claim 9, wherein:

the reference voltage generating means is made up of a plurality of reference voltage generating blocks for partially generating the tone display voltages of different levels, and

the voltage generating means of a lower output impedance is provided for each of the reference voltage generating blocks.

15. The tone display voltage generating device as set forth in claim 9, wherein:

the reference voltage generating units including the reference voltage generating means and one or more of the voltage generating means are adapted so that each of the reference voltage generating units receives



only two reference voltages, the two reference voltages being used to generate the tone reference voltages of different levels.

16. A tone display device, comprising:

the tone display voltage generating device of claim 9; and

a tone display element which carries out tone display by the tone display voltages which are supplied from the tone display voltage generating device.